













# Instruction Manual



## NeurOptics™ VIP™-200 Variable Pupillometer

*From Pupil to Expert ... Precision Guaranteed™*

## Equipment Symbols

| Symbol  | Source/Compliance                                  | Meaning  |
|---|--|--|
|    | Symbol #03-02 IEC 60878                            | ATTENTION, consult ACCOMPANYING DOCUMENTS.                               |
|    | Symbol # 5333 IEC 60417<br>Symbol #02-03 IEC 60878 | TYPE BF equipment  |
|    | Symbol # 02-02 IEC 60878                           | TYPE B equipment   |
|    | Symbol #5032 IEC 60417<br>Symbol #01-14 IEC 60878  | This symbol indicates the equipment is suitable for alternating current. |
|    | Symbol #5007 IEC 60417<br>Symbol #01-01 IEC 60878  | Indicates ON (Power)   |
|    | Symbol #5008 IEC 60417<br>Symbol #01-02 IEC 60878  | Indicates OFF (Power)  |
|    |  | Indicates Intermittent Use   |
|   |  | Indicates Non sterile  |
|  |  | Indicates Keep Dry   |
|  |  | Serial Number  |
|  |  | Model Number   |
|  |  | Lot Number   |

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## ***EMC Notice***

NeurOptics® VIP™-200 Pupillometer (device) generates, uses, and can radiate radio frequency energy. If not set up and used in accordance with the instructions in this manual, electromagnetic interference may result. The equipment has been tested and found to comply with the limits set forth in EN60601-1-2 for Medical Products. These limits provide reasonable protection against electromagnetic interference when operated in the intended use environments (e.g. hospitals) described in this manual.

## ***MRI Notice***

This device contains components whose operation can be affected by intense electromagnetic fields. Do not operate the device in a MRI environment or in the vicinity of high-frequency surgical diathermy equipment, defibrillators, or short-wave therapy equipment. Electromagnetic interference could disrupt the operation of the device.

## ***Intended Use Notice***

The NeurOptics® Pupillometer is a handheld optical scanner which captures and analyzes a series of digital images to obtain a measurement of the diameter of a human pupil. **It should only be operated by properly trained clinical personnel, under the direction of a qualified physician.**

The results obtained from the pupillometer scans are used for information only and are not to be used for any diagnostic process.

## ***Regulatory Notice***

Federal law restricts the sale of this device except by or on order of a physician.

## ***Classification***

**Type of Equipment:** Medical Equipment, Class 1 886.1700

**Trade names:**

NeurOptics® VIP™-200 Pupillometer

**Manufactured by:**

NeurOptics, Inc.  
18101 Von Karman Blvd., Suite 1940  
Irvine, California 92612  
USA

If you have a question regarding this product, please contact NeurOptics at one of the numbers given in Appendix B.

## ***Indications for use***

Used for measuring a dilated or non-dilated pupil.

## ***Contraindications***

Avoid use when the orbit structure is damaged or surrounding soft tissue has an open lesion or edema.

## ***Safety Information***

**Please review the following safety information prior to operating the device.**

Read the Operating Instructions fully before attempting to use the Pupillometer. Attempting to operate the device without fully understanding its features and functions may result in unsafe operating conditions and/or inaccurate results.

If you have a question regarding the installation, set up, operation, or maintenance of the device, contact NeurOptics as shown in Appendix B.

## Terms

---

|                 |  |
|-----------------|--|
| <b>WARNINGS</b> | Identify conditions or practices that could result in serious adverse reactions or potential safety hazards. |
| <b>CAUTIONS</b> | Identify conditions or practices that could result in damage to the device or other equipment.               |
| <b>NOTES</b>    | Identify supplemental information to help you better understand how the device works.                        |

## Warnings

**Warnings and Cautions appear throughout this manual where they are relevant. The Warnings and Cautions listed here apply generally any time you operate the device.**

**Use of the Pupillometer** - The Pupillometer is intended for use by trained clinical personnel, under the direction of a qualified physician.

If a problem is recognized while operating the device, the device must be removed from use and referred to qualified personnel for servicing. Using an inoperative device may result in inaccurate readings.

**Electric shock hazard** - Do not open the device or the docking station. There are no user serviceable parts. Refer *all* servicing to an authorized service technician. Opening up the device will void the warranty.

Use only the specified lithium ion rechargeable battery (P/N BATPUP-01) in the Pupillometer.

Use only power adapters which are shipped with the NeurOptics® Pupillometer system. Using unauthorized parts will void the warranty.

Use only the NeurOptics® charging station for charging Pupillometer batteries.

**Risk of fire or chemical burn** - The battery used in this device may present a risk of fire or chemical burn if mistreated. Do not disassemble, heat above 100 degrees C, incinerate, or dispose of in fire.

**Risk of fire or explosion** - Replace the Pupillometer battery with battery specified in Appendix B. Use of another battery may present a risk of fire or explosion. Dispose of battery promptly. Keep away from children.

## **Cautions**

**The following cautions apply any time you work with the device.**

A battery that is fully drained (i.e. void of any charge) may cause damage to the device and should be replaced.

Be careful when removing the eyecup to ensure that you do not damage the lens. Make sure that you do not "rotate" the lens when fitting or removing the eyecup.

**The following cautions apply when cleaning the device or when sterilizing device accessories.**

The internal components of the Pupillometer are not compatible with sterilization techniques, such as ETO, Steam Sterilization, Heat Sterilization and Gamma.

**DO NOT** submerge the device or pour cleaning liquids over or into the device.

**DO NOT** use acetone to clean any surface of the Pupillometer or charging station.

## Section 1 — Introduction

The NeurOptics® VIP™-200 Pupillometer is a handheld optical scanner which captures and analyzes a series of digital images to obtain measurement of the diameter of a human pupil. The system acquires images using a self-contained infrared illumination source and a digital camera. It analyzes the captured image data and displays a summary of the measurement in the LCD window. Data may also be printed out on an optional thermal printer via an infrared port (IrDA).

The NeurOptics® VIP™-200 Pupillometer uses a menu driven graphical user interface (GUI), with a color LCD screen for data display. A keypad completes the user interface and enables manual entry of individual patient identification (ID) numbers.

The Pupillometer is powered by a 3.7 volt rechargeable lithium ion battery.

Pupillary data sampled at 30fps and for a total duration of 2 seconds is used in the calculation and the final display shows the average and standard deviation of the pupil size during the 2 seconds of measurement (in “Light Off” mode). Under “Variable” mode, pupil diameter is measured under three different background light conditions: Scotopic (light off), Low Mesopic (0.3 lux) and High Mesopic (3 lux).

The NeurOptics® system includes a Pupillometer, a rechargeable battery, two reusable eye cups, and a charging station. Options are listed in Appendix B and can be ordered separately.

### ***Features***

- The NeurOptics® VIP™-200 Pupillometer has been designed to be a lightweight device with a small footprint.
- To compensate for pupillary unrest, the device tracks and averages pupillary information for approximately two seconds.
- The device has the capacity to store approximately 3,000 measurements.
- The optional Seiko™ thermal printer enables hard copy printing of results.

## Section 2 — Unpacking and Setup

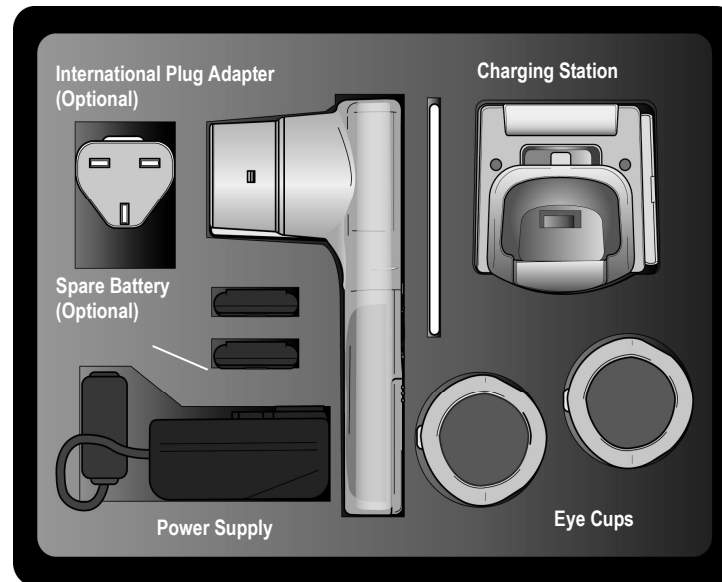


Figure 2.1

### Unpacking

The NeurOptics® system is housed in a protective hard shell case. Included with your system are:

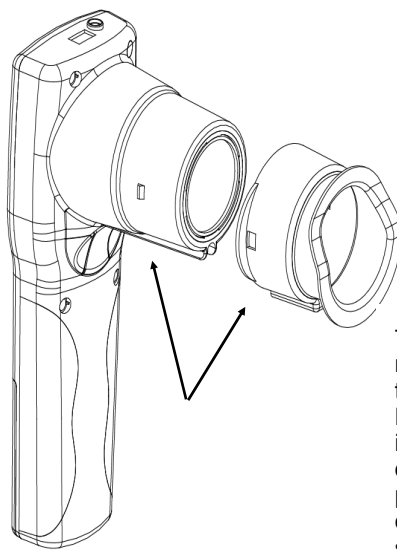
- The Pupillometer
- Lithium ion battery
- Two eye cups
- Medical grade power supply for the charging station
- The charging station.

Please check the contents of your case (Figure 2.1) when delivered. If anything is damaged or missing please contact NeurOptics at once at 949-250-9792.

**DO NOT ATTEMPT TO USE A DAMAGED DEVICE!** The Pupillometer may not function correctly if it has been damaged or tampered with.

## Attaching the Eyecup

The Pupillometer should not be used without the eye cup positioned correctly.



It is very important that the eye cup be correctly fitted. A snug fit helps reduce the possibility of stray light entering the eye while the scans are taking place.

The eye cup has a tab in the rim, which fits into the indentation in the lens shield of the Pupillometer. Position the tab in the eye cup rim into the indent in the lens shield and press into place. The tabs on either side of the lens shield should also snap into the holes on either side of the eye cup.

**Figure 2.2A**

The flexible, contoured eye cup fits onto the Pupillometer as shown in Figure 2.2A. The eye cup is reusable. To clean the eye cup, follow the instructions under Cleaning and Maintenance. To replace it or to order additional eye cups, call the number given in Appendix B and request part number NEUR-2059-01.

**CAUTION**

Do not touch the lens when fitting or removing the cup. Damage to the lens may result.

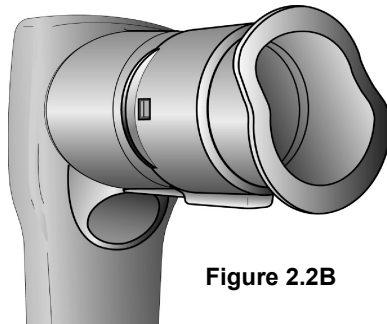


Figure 2.2B

When the eye cup is correctly positioned, the contour of the eye cup should be aligned horizontally as shown in Figure 2.2B.

Always clean the eye cup before taking measurements on each patient (refer to Section 4).

## Connecting the Charging Station

Connect the NeurOptics® medical grade 6-volt power supply included with your system to the center plug in the charging station as shown in Figure 2.3. Connect the power supply to a suitable AC outlet. After a second, you should see a blue LED illuminate on the plug of the power supply and a green LED on the front of the charging station.

The other 2 plugs in the back of the charging station are for Neu-

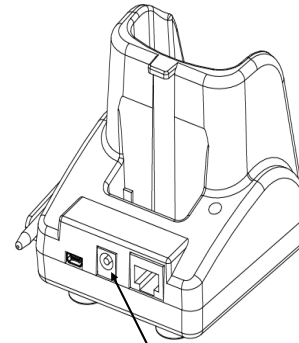


Figure 2.3

**Warning: ONLY use NeurOptics® Part number NEUR-PWR1-01 power supply with the NeurOptics Charging Station. The device may be damaged if an incorrect power supply is used.**

## Charging the Pupillometer

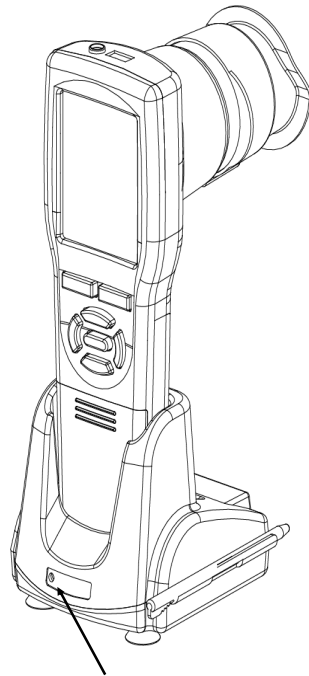


Figure 2.4

Install the Pupillometer battery into the Pupillometer (see Section 4). The battery must be fully charged prior to first use. This may take up to four hours. The battery status is indicated by the battery icon on the LCD screen of the device.

The arrow in Figure 2.4 points to the LED on the front of the charging station which, when lit, indicates that the charging station is powered up correctly.

When placing the Pupillometer into the charging station, the Pupillometer should be inserted at a 90-degree angle straight down until a click is heard. The battery icon in the LCD screen will show a lightning bolt symbol indicates that the device is properly connected to the charging station.

When removing the Pupillometer from the charging station, do not pull straight up. First, *rotate the device forward* and once it releases *then* pull it up. (See Figure 2.6).

When correctly installed, the eye cup on the Pupillometer should be facing the rear of the docking station with the keypad and screen towards the front as shown in Figure 2.4. This will orient the terminals on the Pupillometer with the terminals in the base of the docking station and enable a positive connection.



Figure 2.5

### Note

**IF THE LIGHTNING BOLT superimposed over the battery icon IS NOT VISIBLE on the LCD screen of the device, THE DEVICE IS NOT CHARGING (Figure 2.5).**

**CAUTION**

Do not try to pull the device up out of the charging station without first rotating it forward to release.

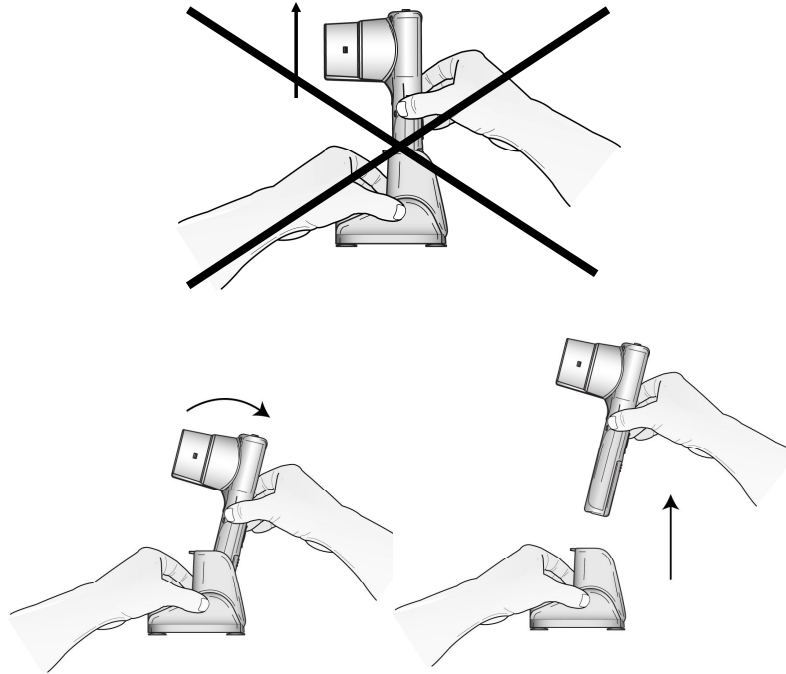


Figure 2.6

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**Note**

***In order to conserve battery power while outside of the charging station, the Pupillometer will go into “sleep” mode after 3 minutes of inactivity. The device will turn itself off after 60 minutes of inactivity.***

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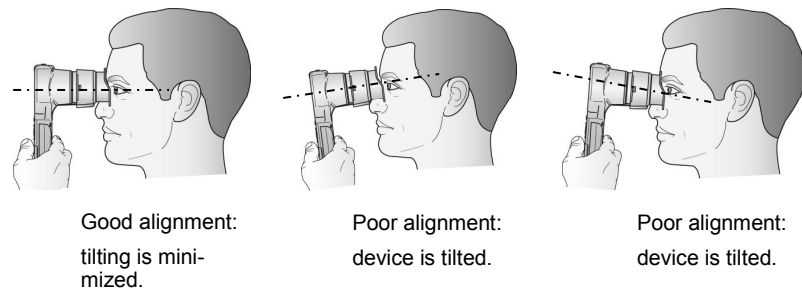
When in *sleep* mode outside of the charging station, the Pupillometer LCD backlight will be turned off and can be turned back on with a quick press-and-release of any button of the keypad. If the device is *turned off*, it can be turned back on by pressing and holding the up arrow key on the keypad for 3 seconds until a beep is heard or by placing the Pupillometer into the charging station.

## ***Taking a Measurement***

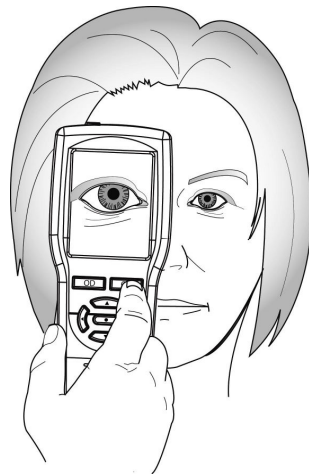
### **Patient and Environment Preparation**

The following preparations will help to optimize the assessment of pupil size :

- Before initiating the measurement scan, turn off or reduce overhead lighting to ensure that the room is darkened.
- Be sure to dark-adapt the subject for 3 minutes or more in case of strong lighting before the measurement.
- Instruct the patient to focus on a small target object (for example, a wall chart, or a dim flashing light) that is at least 10 or more feet (3 meters) away with the eye that is not being tested.
- Ask the patient to keep his head straight and both eyes wide open during both targeting and measurement. In some cases if targeting becomes a problem, it may be necessary to gently hold the patient's eyelid open with your finger.
- The operator should position the instrument at a right angle to the patient's axis of vision and any tilting of the instrument should be minimized (Figure 3.3A).
- It may be helpful for the operator to be at the same level as the patient when performing the scan to minimize tilting. If necessary, both patient and operator can sit down facing each other during targeting and measurement.
- Be aware that in Variable mode, the measurement lasts approximately 12 seconds.



**Figure 3.3A**



**Figure 3.3B**

Pressing the OD or OS button activates the Targeting phase. Press and hold down the OD or OS button and keep the Pupillometer snugly up to the patient's eye. During this phase, a video image of the eye is displayed in the LCD window. The patient's pupil must be centered within the field of view (Figure 3.3B).

## Section 3 — Using the Device

### *Powering on and Menu Navigation*

The unit will turn on automatically when inserted into the charging station or when the battery is installed. If the unit is not on, press and hold the up arrow ▲ for three seconds until a beep is heard or insert the device into the charging station.

Insert the battery and make sure it is fully charged before first usage (refer to Section 4). After the system has booted up, which takes a few seconds, the default measurement screen will display as shown in Figure 3.2A.

The main Menu Bar is displayed at the bottom of the default measurement screen and can be activated (Figure 3.2B) by pressing the down arrow ▼ of the directional keypad (Figure 3.1). Each icon in the Menu Bar corresponds to a different function of the Pupillometer. Notice that the key in the center of the keypad, labeled with a solid circle ●, is the SELECT key.

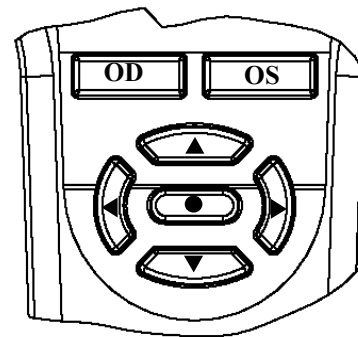
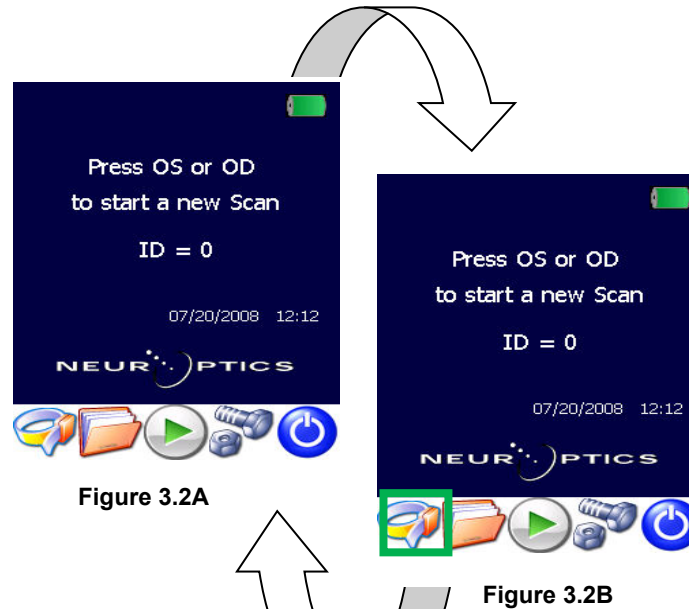


Figure 3.1

To activate the main Menu Bar, press the down arrow key ▼



To exit the Menu Bar or any submenu (see the next Section for an explanation and list of submenus) and return to the default measurement screen, press **OD** or **OS**.

Once the Menu Bar has been activated by pressing the down arrow, the icon which is highlighted will have a square frame drawn around it. To highlight a different icon, use the left or right arrow keys on the keypad ◀ ▶. Once the desired icon has been highlighted, press the SELECT key on the keypad to select that

## Initiating the SCAN

A measurement can only be taken from the default measurement screen (Figure 3.2A). To return to the default measurement screen from any other window, menu, or submenu, press “OD” or “OS” on the keypad. To initiate a new scan from the default measurement screen, press “OD” (right eye) or “OS” (left eye) on the keypad, depending on which eye is going to be measured.

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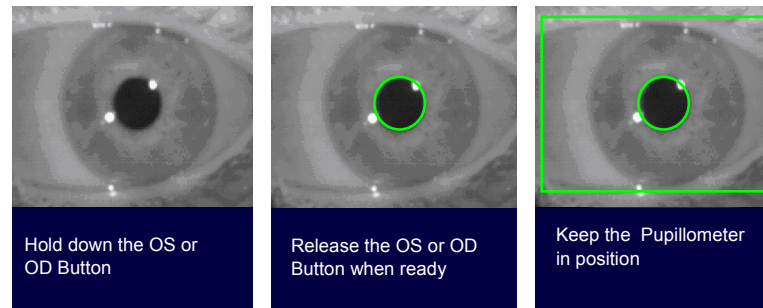
### Note

*The OD or OS keys will initiate a scan from the default measurement screen only (Figure 3.2A). If the OD or OS key is pressed during any other system mode, the Pupillometer will not initiate a new scan but instead will return to the default measurement screen (This is similar to the ESC (escape) key on a computer.)*

---

## Pupil Measurement

A pupil measurement is divided into three distinct phases (Figure 3.4).



Phase 1 - Either the OS or the OD scan button is pressed. Video is enabled and displayed in the Pupillometer LCD screen. The user is required to hold the OS or OD scan button down, position the Pupillometer on the subject's eye and center the subject's pupil in the center of the field of view. This is called the Targeting phase.

Phase 2 - The Pupillometer automatically detects the pupil. The pupil is marked with a green circle drawn around its perimeter. Release the button when ready to initiate the actual measurement (i.e., once the green circle appears around the pupil). This is called the Ready phase.

Phase 3 - When the OS or OD scan button is released, then the actual pupil recording is initiated. Keep the Pupillometer firmly on the subject's eye for the entire duration of the recording which lasts 2 seconds (approx. 12 seconds in Variable mode). Do not move or remove the device while the bracket is visible. Once the measurement is complete, the bracket will disappear and the result will be displayed. At this point the device can be removed from the eye. This is called the Measurement phase.

**Figure 3.4**

If no pupil is found and detected in the field of view during the Targeting Phase, the Pupillometer will not transition to the next (Ready) Phase and the pupil scan cannot be initiated.

The Targeting and Measurement phases take a few seconds (depending on the duration of the Targeting phase), during which time the patient's eye should be wide open, with minimal blinking. While the measurement is being recorded, hold the Pupillometer as still as possible against the orbital rim, minimizing any tilting until the results are displayed on the screen (Refer to Figure 3.3A).

At the end of the Measurement phase the scan results will display almost immediately. If the analysis fails, the Pupillometer displays an error message "Pupil Not Detected!" (Refer to Troubleshooting Section in Appendix A.)

When the measurement for the first eye is complete, return to the default measurement screen by pressing OD or OS, then press the other scan button (OD or OS) and proceed with the measurement of the second eye.

If the patient's eyelid is closed or droopy, instruct the patient to open his/her eyes as widely as possible or use your fingers to keep the eyelid open. If the patient is wearing heavy eye makeup which may interfere with the scan, hold the eyelid open as widely as possible.

The scan is complete when the measurement results are displayed on the LCD screen. At that point the Pupillometer can be removed from the patient's eye.

When the scan(s) is complete, the results screen will display a scanned image with a green circle showing the pupil boundary, Figure 3.5.

---

## WARNING




**If the green pupil boundary circle is NOT centered on the pupil perimeter during the Targeting phase, do not release the scan (OD or OS) button. Also verify that the pupil boundary is circled in the result display. If the green circle is not nicely centered around the perimeter of the eye, the scan is not valid and must be repeated.**

---

The results page (in Light Off mode) (Figure 3.5) shows the diameter of the pupil (Dia) and the standard deviation (std) of pupil diameter measured during the scan. It also includes the ID number of the subject, the date and time of the measurement and, finally, which eye, (OD or OS) was measured.

The short menu bar at the bottom of the results page can be activated with a press of the down arrow key ▼.

Three options are available:

-  To **PLAY** the pupil video of the measurement (Light Off mode only)
-  To **PRINT** the current record (see the Printing the Records section below).
-  To **DELETE** the current record.


The results page (in Variable mode) (Figure 3.6) shows the diameter of the pupil (DIA) and the standard deviation (std) of pupil diameter measured during the scan at three different light levels: Scoptic (Light Off), Low Mesopic (0.3 lux), and High Mesopic (3 lux). It also includes the ID number of the subject (if set), the date and time of the measurement and, finally, which eye, (OD or OS) was measured.

Low Mesopic simulates lighting conditions such as moon illumination, driving at night outside of urban areas, or a dimly lit room. High Mesopic simulates conditions such as moderate night streetlights or early twilight.

|                   |                     |            |
|-------------------|---------------------|------------|
| ID: 0             | 2011/05/16 21:41:35 |            |
| <b>OD</b>         | <b>DIA</b>          | <b>std</b> |
| <b>Scotopic</b>   | <b>7.8 mm</b>       | 0.03 mm    |
| <b>L. Mesopic</b> | <b>7.1 mm</b>       | 0.02 mm    |
| <b>H. Mesopic</b> | <b>6.5 mm</b>       | 0.04 mm    |

V2P-IFU-01

## Patient Identification (ID) number

 To enable recall of patient data, a Patient ID number may be entered before initiating a scan. Assigning a Patient ID number is optional. Measurements can be taken without assigning a Patient ID number.

To assign an ID number, from the default measurement screen press the down arrow on the keypad and select the ID bracelet icon by pressing the SELECT key once that icon is highlighted.

To enter a new ID, press SELECT on the first menu selection “New ID” (Figure 3.7) and a complete keyboard will be displayed in the screen (Figure 3.8). Any combination of lower and upper case letters and numbers can be used to create a new ID, up to a maximum of 9 digits. Numbers or letters can be selected by navigating over the keyboard using the directional keypad and pressing the SELECT (on the Pupillometer keypad) to select the current character or number or symbol. In order to shift between lower and upper case letters and numbers, select the “Shift” key (Figure 3.8). Press the “Enter” key on the displayed keyboard once the new ID is completed. The results of the patient’s next scan will be stored under this ID number.

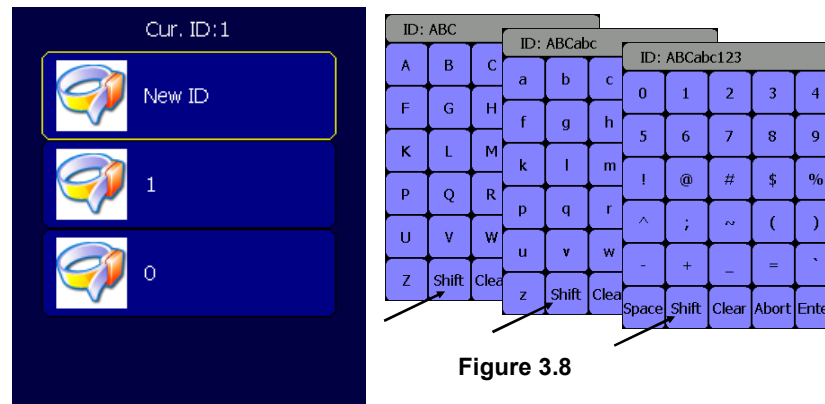


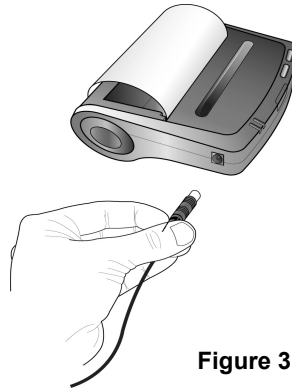
Figure 3.8

Figure 3.7

In case other ID numbers are included in the Pupillometer database stored in memory, these will be listed in the same window (for example in Figure 3.7 see ID 1 and ID 0). The desired Patient ID number can be selected by using the directional keypad (arrow up and arrow down) and then pressing SELECT. This function is useful if you need to immediately re-enter a Patient ID already in the memory without the necessity of typing it again.

## Printing the Records

Attach the power supply to the printer as shown in Figure 3.9. Turn the printer on and the green light will illuminate.



**Figure 3.9**

The patient record currently displayed in the results window (Figure 3.5 and 3.6) can be printed by activating the short menu bar at the bottom of the results page (Figure 3.5 and 3.6) and selecting the printer icon.

The range of the IrDA transceiver on the Pupillometer is less than one meter. If the Pupillometer is too far away from the printer, not pointed directly at the printer IR window (see Figure 3.10), or if the printer is not turned on, the error message "Print Failed" will be reported in the LCD of the Pupillometer. If the connection is successful and printing has been completed, a "Print Done" message will appear. It will take only a few seconds for a single record to print.

During printing, hold the Pupillometer directly in front of the IR (infrared) window of the thermal printer as shown in Figure 3.10. A wireless connection is established with the printer through direct line of sight. The printout is a text summary of the results page (eye, diameter, std, date and time). If you want to print a measurement other than the last measurement taken, refer to the "Browsing Records to View and Print" section.

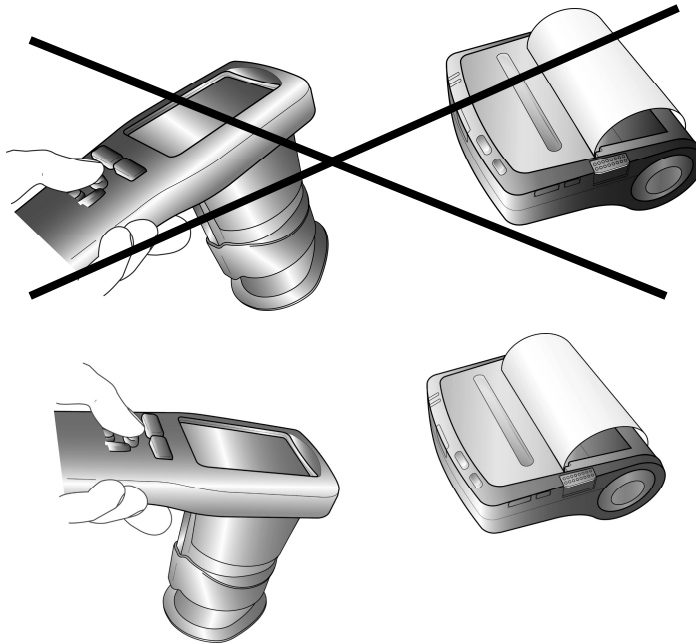


Figure 3.10

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**Note**

*The system will only print a record when data is displayed on the screen (i.e., after a measurement or when “browsing records”).*

*Consult the printer’s instruction manual for specific printer operation instructions.*

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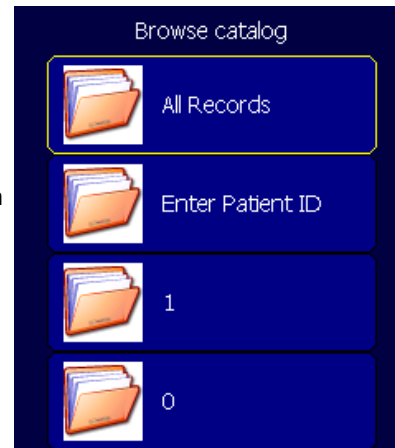
## ***Browsing Records to View and Print***



You can browse, retrieve and print data from previous measurements. To do this, select the folder icon in the main Menu Bar.

In the Browse catalog window (Figure 3.11) you can select which patient to browse (and print). You can decide to browse all records in memory (“All Records”, Figure 3.11) or a specific patient ID number (“Enter Patient ID”, Figure 3.11). For your convenience, the Browse catalog lists all the most recent patient ID numbers so that you can select directly from the catalog without having to re-enter the Patient ID using option “Enter Patient ID”.

All records corresponding to the ID specified in the Browse catalog window will be displayed (as in Figure 3.5 and 3.6). You can review each single record using the right and left arrow keys in the directional keypad (Figure 3.1). Each time a record is displayed in the LCD, you can decide to print it by selecting the printer icon on the menu bar located at the bottom of the record display.



**Figure 3.11**

## Menu Options

The Main Menu bar provides a few more functions:



### Settings

If this icon is selected in the Main Menu, the “Settings” window will be displayed in the LCD (Figure 3.12).

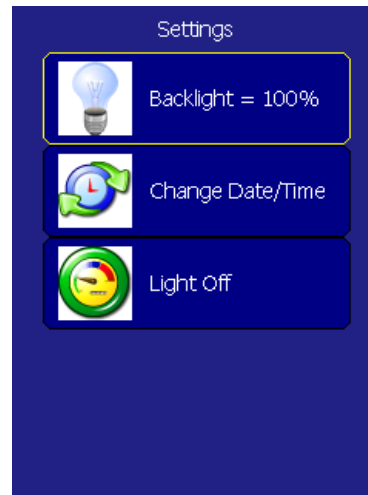


Figure 3.12

This window allows you to:



Dim the LCD backlight illumination. Press the “SELECT” key to toggle between different backlight illumination levels and then press OD or OS to save and exit.



Change the Pupillometer date and time. If selected, the numeric keyboard will be displayed on the LCD (Figure 3.8). The current date and time will be reported on the top of the keyboard. These settings can be changed by pressing “Clear” and re-entering the correct settings using the directional keypad of the Pupillometer (Figure 3.1). Press SELECT to save the new settings for the date and repeat the same steps for setting the time (whose keyboard is automatically displayed after date has been set). Note that time is in 24-hour format (i.e., from 00:00 to 23:59.)



Toggle between Light Off and Variable modes. Press the “SELECT” key to toggle between the two modes. In the Variable mode, the eye is exposed to a sequence of three consecutive light backgrounds simulating Scotopic, Low Mesopic and High Mesopic viewing conditions. The duration of the measurement is approximately 12 seconds.



## Play Video

If this icon is selected from the Main Menu, a video of the latest valid scan will be played back on the Pupillometer LCD. Only the last measurement taken is saved in memory and available for playback.

---

### **Note:**

***Video is only saved in the “Light Off” mode and not in the “Variable” mode.***

---



## Power Off

This icon is for turning the device off. The Pupillometer will ask you for confirmation before performing this operation. The device can be powered back on by pressing the up arrow key for 3 continuous seconds until a beep is heard or by placing the device into the charging station.

## Section 4 — Cleaning & Maintenance

### ***Cleaning***

The NeurOptics® Pupillometer and charging station are non sterile products.

**DO NOT** attempt to sterilize any part of the NeurOptics® Pupillometer system, as sterilization may damage the device.

To clean the surfaces of the NeurOptics® Pupillometer, eye cup or charging station, use a soft, lint-free wipe with a quaternary disinfectant or isopropyl alcohol (IPA) 50% IPA/50% water.

**DO NOT** immerse or drip liquids on to the Pupillometer or charging station.

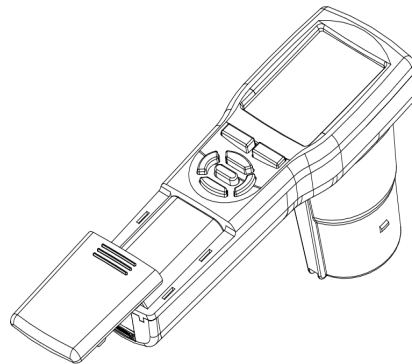
**DO NOT** use acetone to clean any surface of the Pupillometer or charging station.

The LCD window should be cleaned using a soft, lint-free wipe and IPA.

Clean the lens with lens cleaning solution and a lint free cloth.

### ***Changing the Battery***

To maximize available battery reserve, it is recommended that the Pupillometer be stored in the connected charging station when not in use.



To change the battery, open the housing compartment by pressing down to release the catch and pulling outward. (Figure 4.1) Insert the battery with the terminals as indicated on the label in the battery compartment.

**Figure 4.1**

Place the Pupillometer into the charging station to charge the battery until the battery status light on the LCD shows green, indicating a full charge.

A battery status icon is visible on the main LCD screen which changes shape and color as the battery is depleted.

When the Pupillometer has a full charge, the battery status icon is shown as fully green .



As the charge decreases, the area inside the icon reduces and will eventually change into yellow.



A severely depleted battery is displayed by the level indicator being reduced to the very bottom and the color changes to red.



During charging, a lightning bolt is overlaid on a blue battery icon; a completely charged battery is shown with a lightning bolt overlaid on green battery icon when the device is kept in the charger.

---

## Note

***Using the device when it is in red battery status is strongly discouraged.***

***Batteries should be recycled or disposed of in accordance with local ordinances in force in your area.***

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## Printer Maintenance

The optional Seiko™ thermal printer is shipped with its own user's manual. Please refer to it for instructions as to loading paper, general use and safety.

## Appendix A — Troubleshooting

| <b>Issue</b>  | <b>Possible Reason</b>  | <b>Solution</b>  |
|---|---|--|
| Device will not turn on                                       | Using incorrect power supply  | Use only power supply provided with Pupillometer. Check label on power supply.   |
| Device will not turn on                                       | Power cord is not fully plugged into the wall or the charging station | Check connections  |
| Device will not turn on                                       | Battery not installed correctly in device                             | Remove and replace following instructions in Instructions for Use (IFU)  |
| Device will not turn on                                       | Battery completely discharged   | Verify that battery is installed correctly into the device. Charge the battery by positioning the Pupillometer into the charger (see instructions in IFU)            |
| Battery will not charge                                       | Device is not placed in charging station correctly                    | Make sure to push device straight down into the charging station following instructions in the IFU and that a lightning bolt symbol is displayed on the battery icon |
| "Pupil not detected!" error message after measurement attempt | Device not held correctly   | Hold device at a 90-degree angle to patient's face. Make sure subject's eye is centered on the screen.   |
| "Pupil not detected!" error message after measurement attempt | Too much blinking or heavy makeup                                     | Gently hold patient's eye open with your finger during measurement   |
| "Pupil not detected!" error message after measurement attempt | Device removed from eye before measurement phase completed            | Don't remove device from eye until measurement results are displayed on the screen.  |

| <b><u>Issue</u></b>   | <b><u>Possible Reason</u></b>   | <b><u>Solution</u></b>   |
|---|---|--|
| Pupil measurement will not initiate after release of the OD or OS key | The same reasons (and solutions) as discussed above apply here                              |  |
| Record will not print   | Pupillometer held too far away from printer or not in line of sight of IR window of printer | Pupillometer must be held in direct line of sight of IR window of printer. See instructions in IFU                   |
| Record will not print   | Measurement to print is not shown in the active screen                                      | Browse to find record to print, then follow instructions in IFU.   |
| Video will not play   | Pupil measurement not successfully completed and video not present in memory                | Perform and complete a pupil successful measurement. Play video back before taking a new scan or turning device off. |
| Patient ID number is not displayed                                    | “Enter” key on screen keyboard not pressed after entering Patient ID                        | Select and press “Enter” on screen keyboard after entering patient ID number.  |

## **Appendix B — Contact & Ordering Information**

The following **options and accessories** can be ordered from NeurOptics:

|                   |   |
|-------------------|---|
| VIP™-200 Variable | NeurOptics® Pupillometer – US                 |
| NEUR-PWR1-01      | Pupillometer Charger/Power Supply – US        |
| VIP-CHG-01        | NeurOptics® Pupillometer Charging Station     |
| BATPUP-01         | NeurOptics® Pupillometer Rechargeable Battery |
| NEUR-2059-01      | NeurOptics® Pupillometer Eye Cup              |
| NEUR-PRTS445      | Seiko™ Printer                                |
| NEUR-PRTPSUS      | Seiko™ Printer Power Supply – US              |
| NEUR-PRTCBUS      | Seiko™ US Printer Cable                       |
| 49006             | Seiko™ Printer Paper                          |
| NEUR-CASE-02      | NeurOptics® Pupillometer Carrying Case        |

For more information, please contact NeurOptics or visit  
[www.NeurOptics.com](http://www.NeurOptics.com)



**Distributed by:**

**NeurOptics, Inc.**

US Customer Service:

18101 Von Karman Blvd., Suite 1940

Irvine, CA 92612

USA

Tel: 949.250.9792 or 866.99.PUPIL (Toll Free North America)

Fax: 949.250.9796

[info@NeurOptics.com](mailto:info@NeurOptics.com)

## Appendix C

### Clinical Phenomena Affecting Pupillary Measurement

#### **Pupillary Unrest:**

The pupil is always in motion due to a phenomenon referred to as Pupillary Unrest, Pupillary Noise, or Hippus. The magnitude of this motion can be as large as  $\pm 0.5$  mm in amplitude. **Therefore, the presence of pupillary unrest limits the accuracy of single snap-shot measurements of pupil size.**

The NeurOptics® VIP™-200 Pupillometer is designed to mitigate the effects of pupillary unrest on pupil size measurements by collecting data over an approximate two-second period. The Pupillometer reports the average detected pupil size over this period, as well as the standard deviation.

#### **Vertex Variation:**

The distance of the corneal apex to the first optical surface of an instrument is referred to as the “vertex distance”. Natural biological variation in the general population results in an anatomical vertex distance range of approximately 12 mm.

For modern pupillometers which are used in close proximity to the eye, this 12 mm variation can account for a significant fraction of the object distance to the eye. Therefore, the projected scale of a pupillometer which has not been adjusted for vertex distance may result in a significant measurement error of pupil size. To compensate for potential differences in vertex distances, the NeurOptics® Pupillometer utilizes the NeurOptics® VIP™ (Vertex Invariant Pupillometry) technology, which reduces or eliminates the impact of vertex distance on pupillometry measurements.

*Usui, Shiro and Stark, Lawrence; "Sensory and Motor Mechanisms Interact to Control Amplitude of Pupil Noise." Vision Research 1978; 18:505-07*

*Migliori, ME, and Gladstone, GJ, "Determination of the normal range of exophthalmometry for black and white adults." American Journal of Ophthalmology 1984; 98:438-42*

## Appendix D — Specifications:

### NeurOptics® Pupillometer - Model # VIP™-200 Variable

|   |  |
|---|--|
| <b>Measurement Characteristic</b>   | <p>Input: Human pupil size varying from 1 mm-9 mm.</p> <p>Output: The instrument provides data on pupil size: Average pupil aperture and standard deviation</p> <p>Accuracy: <math>\pm 0.1\text{mm}</math></p> |
| <b>Type of protection against electric shock</b>  | See Battery Charger (Class II )  |
| <b>Degree of protection against Electric Shock</b>  | Pupillometer Eyecup – Type BF Applied Part provided protection.  |
| <b>Classification of the equipment against ingress of liquids</b>   | Ordinary equipment   |
| <b>Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide</b> | The equipment is not an AP or APG category equipment   |
| <b>Mode of Operation</b>  | On Demand battery operation  |
| <b>Power Supply:</b>  | 3.7V 1800mA/hour Li: Ion Cell (battery)  |
| <b>Operating Environment:</b>   | <p>Temperature Range: 18°C (65°F) to 30°C(86°F)</p> <p>Relative Humidity: 20 % to 70 % RH. Non-condensing at all times</p>   |
| <b>Transportation and Storage Environment:</b>  | <p>Temperature: 0°C (32°F) to 75°C (167°F)</p> <p>Relative Humidity: 10 % to 95 % RH Non-condensing at all times</p>   |
| <b>Dimensions:</b>  | <p>With Headrest: 7.5" (191 mm) x 2.65" (67 mm) x 4.65" (118 mm)</p> <p>Without Headrest: 7.5" (191 mm) x 2.65" (67 mm) x 3.65" (93 mm)</p>  |
| <b>Weight:</b>  | 356 g $\pm$ 10g  |
| <b>Classification:</b>  | Class 1 LED product per IEC 60825  |

## Accessories

|   |  |
|---|--|
| <b>NeurOptics® Charging Station - Model # VIP-CHG-01</b>  |  |
| <b>Degree of protection against Electric Shock</b>  | Type B Applied Equipment                               |
| <b>Type of protection against electric shock</b>  | Class II Battery Charger                               |
| <b>Classification of the equipment against ingress of liquids</b>   | Ordinary equipment                                     |
| <b>Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide</b> | The equipment is not an AP or APG category equipment   |
| <b>Mode of Operation</b>  | Continuous operation                                   |
| <b>Power Supply:</b>  | Input: 100-240 VAC $\pm$ 8%<br>Output: 6V, 2.8 Amps    |
| <b>Power Line Frequency:</b>  | 50/60 Hz   |
|   |  |
| <b>Seiko™ thermal printer<br/>Model # NEUR-PRTS455</b>  | Optional. See separate owners manual for instructions. |

## Warranty

**A. Standard Limited Warranty.** NeurOptics (the Manufacturer) warrants to the original end user purchaser (the Purchaser) that the enclosed product (Product) purchased by the Purchaser, at the time of delivery to the Purchaser, shall be substantially free from defects in material and workmanship. The Manufacturer makes no warranty (express, implied, or statutory) for Products that are modified (except as expressly contemplated herein) or subjected to unusual physical stress, misuse, improper operation, neglect, improper testing, use in combination with other products or components other than those for which the Products were designed, or use in any manner or medical procedure for which the Products are not indicated. If the Product is opened up by anyone other than an authorized service technician of NeurOptics, the warranty shall be void.

**B. Remedy.** Purchaser's exclusive remedy and the Manufacturer's sole liability for breach of the foregoing warranty shall be, at the Manufacturer's sole option and election, to replace the Product or credit Purchaser for the net amount actually paid for any such Product; provided that (i) the Manufacturer is notified in writing within one (1) year after Purchaser's receipt of the Product that such Product failed to conform, including a detailed explanation in English of any alleged nonconformity; (ii) such Product is returned to the Manufacturer within one (1) year after Purchaser's receipt of the Product as designated by the Manufacturer and (iii) the Manufacturer is reasonably satisfied that the claimed nonconformities actually exist. Except as expressly provided in this paragraph, Purchaser shall not have the right to return Products to the Manufacturer without the Manufacturer's prior written consent.

**C. Exclusion of Other Warranties.** EXCEPT FOR THE LIMITED WARRANTY PROVIDED IN (A) ABOVE, NEUROPTICS GRANTS NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, AND MANUFACTURER SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NEUROPTICS NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME ANY OTHER LIABILITIES ARISING OUT OF OR IN CONNECTION WITH THE SALE OR USE OF ANY PRODUCT.

## Returned Goods Policy

Products must be returned in unopened packages, with manufacturer's seals intact, to be accepted for replacement or credit, unless returned due to a complaint of product defect or mislabeling. Determination of a product defect or mislabeling will be made by NeurOptics, which determination will be final. Products will not be accepted for replacement or credit if they have been in the possession of the customer for more than thirty (30) days.